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An Annotated Checklist of Larger Moths (Lepidoptera: Heterocera, except Geometridae and Noctuidae) of the Kamchatka Peninsula, with Notes on Their Zoogeography

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Abstract A checklist of the larger moths of Kamchatka is presented. A total of 32 species belonging to nine families is recorded. Of these, one species, *Eilema atratulum*, is a new record for Kamchatka. The two subspecies, *Palimpsestis duplaris kamtschadalis* Sheljuzhko 1926 and *Palimpsestis duplaris malaisei* Nordstrom 1929, are made synonyms of the nominotypical form. The local Lepidoptera fauna is represented mainly by species associated trophically with deciduous trees and shrubs widely distributed throughout the boreal zone of Eurasia. Zoogeographically, it is composed of the following four major elements: species distributed in the high latitude of the Palaearctic or Holarctic regions; species widely distributed in the temperate zone of the Palaearctic or Holarctic regions; species with more or less wide distribution in the East Palaearctic; species of cosmopolitan distribution. There are no endemic taxa in Kamchatka among the Lepidoptera discussed, and this seems to indicate a young age for the local fauna. It is suggested that the local fauna was formed after the last glacial epoch, most likely during the climatic optimum of the Holocene.

Key words: Lepidoptera, Heterocera, faunistics, zoogeography, Kamchatka.

Taxonomic and faunal studies of Lepidoptera in the Kamchatka Peninsula have a history of more than 100 years. Alphéraky (1897) and Herz (1897) are the earliest references, reporting chiefly Rhopalocera based upon rather small collections made by the latter author during his trip to Jakutia and Kamchatka in 1890. The first data about nocturnal moths, including Macroheterocera, were obtained during Swedish expeditions to Kamchatka, undertaken in 1920–1922. The results of these expeditions were published in short faunistic papers (Corti, 1929; Nordström, 1928, 1929). Some additional data concerning the distribution of the little known Lymantriidae and Arctiidae in Kamchatka are scattered in the literature, including a fundamental review and generic revisions (Kozhantschikov, 1948; Kozhantschikov, 1950; Sotavalta, 1965).

The most comprehensive research on the entomofauna of Kamchatka was carried out by A. I. Kurentzov and his colleagues in 1958–1960. Although abundant material was accumulated during their expeditions, unfortunately the greater part of the faunistic data has not been summarized, and the data are scattered throughout zoogeographic papers or articles dealing with the injurious insects among the local fauna (Kurentzov, 1963a, 1963b, 1966, 1967; Ivliev, 1966). Sedyh (1979) compiled a checklist of Lepidoptera of Kamchatka based on the published information and his own data. So far, this paper remains the most complete list of the local Lepidoptera. However, there are many misidentifications and doubtful records in Sedyh's list. Since then, only two papers based on local material have been published (Lobkova, 1986; Smetanin, 1990). Some corrections and additions to the list by Sedyh (1979) have been made in the following regional outlines, devoted to the taxonomic structure of the Notodontidae (Tshistjakov, 1985), Arctiidae (Dubatolov, Tshistjakov and Ammosov, 1991) and Sesiidae (Gorbunov and Tshistja-

kov, 1995) of the Russian Far East fauna. Thus, in spite of the one-hundred-year history of the local Lepidoptera study, it is still far from a complete inventory.

In this paper an annotated checklist of the larger moths of the regional fauna is compiled based on the published data and on an examination of material collected during the joint Russian-Japanese expeditions to Kamchatka (1997–1998). The biogeography of the species is also discussed.

Annotated Checklist of the Larger Moths of Kamchatka

In the check-list, information is provided for each species in the following sequence: (1) scientific name; (2) synonyms originally described from Kamchatka or which have been used in the literature, dealing with Kamchatian fauna; (3) material examined (only in the case of new records); (4) local occurrence in Kamchatka; (5) general distribution; (6) host plant(s), if available; (7) remarks, if necessary. All enumerated material is deposited in the collection of the Institute of Biology and Pedology, Far Eastern Branch Russian Academy of Sciences, Vladivostok. The material of the author are given without indication. The collecting sites (local occurrence) mentioned in the list are shown in Fig. 1.

In addition to the enumerated species, another one, *Spilarctia subcarnea* Walker, was recorded from Kamchatka (Kurentzov, 1966; Ivliev, 1966; Sedyh, 1979) as a serious pest of birches. However, it was shown that these records were based on mislabeled material (Dubatolov *et al.*, 1991). So far, there is no certain record of this species from Kamchatka.

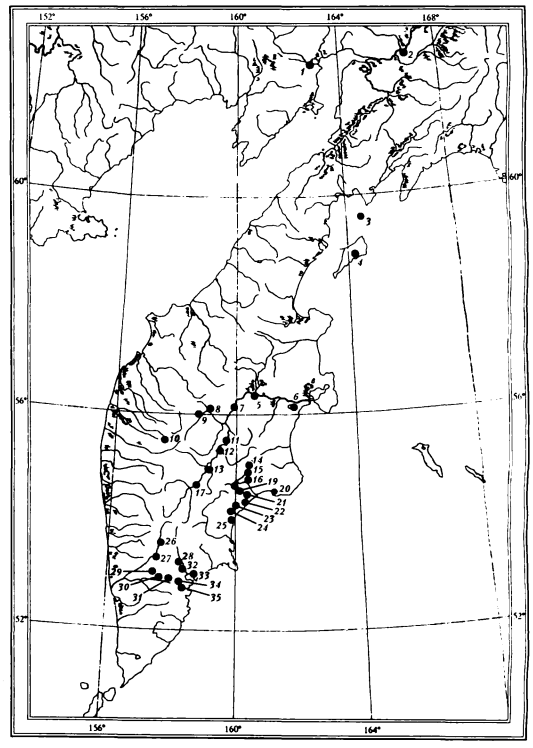

Fig. 1. Collecting sites of the larger moths in Kamchatka. 1, Paren' River; 2, Penzhina River; 3, Verhoturova Island; 4, Karaginskii Island; 5, Klyuchi; 6, Azhabach'e Lake; 7, Kosyrevsk; 8, Anavgai; 9, Esso; 10, Aga Mt.; 11, Laso; 12, Shchapino; 13, Mil'kovo; 14, Baran'ya River; 15, Listvennichnaya River; 16, Kronotskoe Lake; 17, Sharomy; 18, Geisernaya River; 19, Uson volcano; 20, Kronoki; 21, Kikhpinych volcano; 22, Shumnaya River; 23, Staryi Semyachik River; 24, Novyi Semyachik River; 25, Zhupanovo; 26, Gannaly; 27, Malki; 28, Koryaki; 29, Dal'nii; 30, Nachiki; 31, Vachkazhez volcano; 32, Elisovo; 33, Pertopavlovsk-Kamchatskii; 34, Sosnovka; 35, Paratunka.

Hepialidae

1. *Gazoryctra fuscoargentea* (Bang-Haas, 1927)

Hepialus sordida Nordström, 1929: 6.
Hepialus fuscoargenteus sordida: Sedyh, 1979: 289.
Gazoryctra fuscoargentea: Tshistjakov, 1997: 318.

Local occurrence. Verhoturova Island (Tshistjakov, 1997).

Distribution. North Europe (Finland), Yakutia, Magadan territory, Chukotka, Kamchatka, East Sayan Mountains.

Host plants. Unknown.

Sesiidae

2. *Pennisetia hylaeiformis* (Laspeyres, 1801)

Pennisetia hylaeiformis: Gorbunov and Tshistjakov, 1995: 4

Local occurrence. Klyuchi (Gorbunov and Tshistjakov, 1995).

Distribution. North, West, Central and East Europe, Caucasus, South and East Siberia, Russian Far East (except extreme north), Japan.

Host plants. Rubus spp.

3. *Synanthedon scoliaeforme* (Borkhausen, 1789)

Sesisa formicaeformis: Kurentzov, 1963b: 19.
Synanthedon spheciformis: Ivliev, 1966: 86 (part).
Synanthedon vespiformis: Sedyh, 1979: 289.
Synanthedon scoliaeforme: Gorbunov and Tshistjakov, 1995: 8.

Local occurrence. Klyuchi (Gorbunov and Tshistjakov, 1995), Milkovo (Sedyh, 1979).

Distribution. West, Central and East Europe (northwards beyond the Arctic circle), Caucasus, North Kazakhstan, Siberia, Russian Far East (Kamchatka, Middle Amur, Primorye, Sakhalin), Japan (Hokkaido and Honshu).

Host plants. Betula spp.

4. *Synanthedon spheciforme* (Denis and Schiffermüller, 1775)

Sesia spheciformis: Kurentzov, 1963b: 19; Ivliev, 1966: 86.
Synanthedon spheciformis: Sedyh, 1979: 289.
Synanthedon spheciforme: Gorbunov and Tshistjakov, 1995: 9.

Local occurrence. Shchapino (Gorbunov and Tshistjakov, 1995).

Distribution. Europe, North Kazakhstan, Siberia, Russian Far East (Kamchatka, Middle Amur, Primorye).

Host plants. Alnus spp., *Betula spp.* and *Salix* spp.

5. *Synanthedon herzi* Spatenka and Gorbunov, 1992

Synanthedon formicaeformis: Kurentzov, 1963 b: 19; Ivliev, 1966: 86; Sedyh, 1979: 289.
Synanthedon herzi: Gorbunov and Tshistjakov, 1995: 10.

Local occurrence. Shchapino, Klyuchi, Kosyrevsk (Gorbunov and Tshistjakov, 1995).

Distribution. Siberia eastward of Enisej River (Yakutia), Far East of Russia (Magadan territory, Kamchatka, Middle Amur, Primorye, Sakhalin), Mongolia, North China (?), North Japan.

Host plants. Salix spp.

6. *Synanthedon tipuliforme* (Clerck, 1759)

Synanthedon tipuliforme: Gorbunov and Tshistjakov, 1995: 13.

Local occurrence. Kozyrevsk (Gorbunov and Tshistjakov, 1995).

Distribution. Europe, Caucasus, Middle Asia, Siberia, throughout Russian Far East (excluding extreme north). Introduced also into North America, Australia, New Zealand and Tasmania.

Host plants. Ribes spp.

Drepanidae

7. *Falcaria lacertinaria* (Linnaeus, 1758)

Drepana lacertinaria: Sedyh, 1979: 293

Local occurrence. Kozyrevsk. Milkovo, Pogranichnyi, Elisovo (Sedyh, 1979).

Distribution. Europe, North Kazakhstan, Siberia, Russian Far East (Kamchatka, Middle Amur).

Host plants. Betula spp. and *Alnus* spp.

Thyatiridae

8. *Tetheella fluctuosa* (Hübner, 1803)

Palimpsestis fluctuosa: Sedyh, 1979: 294.
Cymatophora fluctuosa: Lobkova, 1986: 111.

Local occurrence. Kozyrevsk, Novyi Semyachik River, Pogranichnyi, Elisovo, Petropavlovsk-Kamchatskii, Zhupanovo (Sedyh, 1979; Lobkova, 1986).

Distribution. Europe, North Kazakhstan, Siberia, Russian Far East (except extreme north), China, Korea, Japan.

Host plants. Betula spp.

9. *Ochropacha duplaris* (Linnaeus, 1761)

Palimpsestis duplaris kamtschadalis Sheljuzhko, 1926: 61. **Syn. nov.**
Palimpsestis duplaris malaisei Nordström, 1929: 5. **Syn. nov.**
Palimpsestis duplaris: Sedyh, 1979: 294.
Cymatophora duplaris: Lobkova, 1986: 112.

Material examined. **Kamchatka Peninsula**: 10 males, 3 females, 40 km W of Ust'-Kamchatsk, Azhabach'e Lake, 15. VII. 1996.

Local occurrence. Kozyrevsk, Staryi and Novyi Semyachik, Shumnaya, Tikhaya and Listvennichnaya rivers, Petropavlovsk-Kamchatskii, Zhupanovo (Sedyh, 1979; Lobkova, 1986).

Distribution. Europe, North Kazakhstan, Siberia, Russian Far East (except extreme north), Northeastern China.

Host plants. Salix spp. and *Betula* spp.

Remarks. The two nominal subspecies, *Palimpsestis duplaris kamtschadalis* Sheljuzhko, 1926, and *Palimpsestis duplaris malaisei* Nordstrom, 1929, were separated from the nominotypical taxon by the ground color and wing pattern. Sheljuzhko (1926) noted that the presence of a connecting bar between the two distal dots on the forewings and the pure white hind-wings are characteristic for his new taxon. Nordström (1929) characterized his new taxon by the presence of a similar connecting bar on the forewings and hindwings with a dark gray outer margin. However, an examination of the material from Kamchatka has shown that the color of the hindwings varies greatly from pure white to grayish with a marked dark gray outer margin; the connecting bar between the two distal dots on the forewing is found only in three specimens, while the other seven specimens have no such bar and the maculation of their forewings is very similar to that of the nominotypical taxon. Moreover, there are no significant differences in the male genitalia between the populations from Kamchatka and those from the continental part of Eurasia. Therefore, these two subspecific names are made synonymous with the nominotypical name. The validity of the synonymy is supported by the fact that the individuals referable to the two nominal taxa are found sympatrically.

Lasiocampidae

10. *Cosmotriche lobulina* (Denis and Schiffermüller, 1775)

Selenephera (sic) lunigera: Kurentzov, 1963b: 18.
Selenophora lunigera: Sedyh, 1979: 292.
Cosmotriche lunigera: Zolotuhin, 1992: 513.

Local occurrence. Low Penzhina River (Kurentzov, 1963b).

Distribution. Europe, Siberia, Russian Far East (except extreme north), Mongolia, North-Eastern China, Korea, Japan (Hokkaido, Honshu).

Host plants. Abies spp., *Larix* spp. and *Pinus* spp.

Sphingidae

11. *Marumba gaschkewitschi* (Bremer and Grey, 1853)

Marumba gaschkewitschi: Kurentzov, 1963a: 48; 1963b: 20, 29; 1966: 71.

Local occurrence. Middle part of Kamchatka river valley (Kurentzov, 1963a; 1963b; 1966).

Distribution. Tibet, China, East Mongolia, south of Russian Far East (Middle Amur, Primorye, Kamchatka), Korea, Japan, Taiwan.

Host plants. Malus spp. and *Crataegus* spp.

12. *Hyles gallii* (Rottemburg, 1775)

Deilephilia gali (sic): Kurentzov, 1963b: 37.
Deilephilia galii (sic): Sedyh, 1979: 289.

Local occurrence. Zhupanovo (Sedyh, 1979).

Distribution. Temperate and boreal zones of Holarctic.

Host plants. Chamaenerium spp., *Galium* spp., *Euphorbia* spp. and *Rumex* spp.

Notodontidae

13. *Furcula furcula sangaica* (Moore, 1877)

Cerura lanigera: Nordström, 1929: 4; Sedyh,

1979: 289.
Furcula lanigera: Tshistjakov, 1985: 55.

Material examined. **Kamchatka Peninsula**: 1 male, 11 km N of Malki, 5. VII. 1996.
Local occurrence. Malki, Pogranichnyi, Sosnovka, Elisovo, Petropavlovsk-Kamchatskii, Paratunka, Zhupanovo (Sedyh, 1979).
Distribution. East Sayan Mountains, Russian Far East (except extreme north), Mongolia, North-Eastern, Central and East China, Korea, Japan.
Host plants. Salix spp.

14. *Furcula bicuspis* (Borkhausen, 1790)

Cerura furcula: Sedyh, 1979: 289.
Furcula infumata: Tshistjakov, 1985: 54.

Material examined. **Kamchatka Peninsula**: 1 male, 17 km NE of Malki, 28. VII. 1997.
Local occurrence. Malki, Sosnovka, Elisovo, Petropavlovsk-Kamchatskii, Paratunka (Sedyh, 1979).
Distribution. Europe, Southern Siberia, Russian Far East (except extreme north), Northeastern China, Korea, Japan (Hokkaido, Honshu).
Host plants. Betula spp. and *Alnus* spp.

15. *Notodonta dembowskii* Oberthür, 1879

Notodonta dromedarius: Sedyh, 1979: 289; Lobkova, 1986: 114.
Notodonta dembowskii: Tshistjakov, 1985: 59.

Material examined. **Kamchatka Peninsula**: 1 male, 17 km NE of Malki, 28. VII 1997.
Local occurrence. Pogranichnyi, Sosnovka, Elisovo, Petropavlovsk-Kamchatskii, Paratunka, Zhupanovo (Sedyh, 1979; Lobkova, 1986).
Distribution. Russian Far East (except extreme north), North-Eastern China, Korea, Japan.
Host plants. Betula spp.

16. *Notodonta torva* (Hübner, 1803)

Notodonta tritophus: Sedyh, 1979: 289.
Notodonta torva: Tshistjakov, 1985: 60.

Material examined. **Kamchatka Peninsula**: 3 males, 11 km N of Malki, 5. VII.1996; 1 male, 23 km SE of Anavgai, 8. VII 1996; 4 males, 17 km NE of Malki, 28. VII. 1997.
Local occurrence. Malki, Anavgai, Pogranichnyi, Sosnovka, Elisovo, Petropa-vlovsk-Kamchatskii, Paratunka, Zhupanovo (Sedyh, 1979).
Distribution. Europe, Siberia, Russian Far East (except extreme north), Northeastern China, Korea, Japan.
Host plants. Populus spp., *Salix* spp.

17. *Notodonta ziczac* (Linnaeus, 1758)

Notodonta ziczac: Nordström, 1929: 5; Sedyh, 1979: 289.

Material examined. **Kamchatka Peninsula**: 3 males, 11 km N of Malki, 5. VII. 1996; 1 male, 23 km SE of Anavgai, 8. VII. 1996; 4 males, 17 km NE of Malki, 28. VII. 1997.
Local occurrence. Petropavlovsk-Kamchatskii (Sedyh, 1979).
Distribution. Europe, Caucasus, Transcaucasus, Tian-Shan' Mountains, South Siberia, Transbaikalia, Yakutia, Russian Far East (Kamchatka).
Host plants. Betula spp., *Populus* spp. and *Salix* spp.

18. *Pheosia rimosa* Packard, 1864

Pheosia dictaeoides: Nordström, 1929: 4; Kurentzov, 1963b: 19; Sedyh, 1979: 289; Lobkova, 1986: 113.
Pheosia tremulae: Kurentzov, 1963a: 48; Sedyh, 1979: 289.
Pheosia fusiformis continentalis Tshistjakov, 1985: 57.

Material examined. **Kamchatka Peninsula**: 4 males, 40 km W of Ust'-Kamchatsk, 12-15. VII.1996; 3 males, 11 km N of Malki, 5.VII. 1996; 3 males, 23 km SE of Anavgai, 8.VII. 1996; 4 males, 17 km NE of Malki, 28.VII. 1997.
Local occurrence. Ust'-Kamchatsk, sea coast between Staryi Semyachik and Tikhaya rivers, Uson volcano, Kikhpinych volcano, Geisernaya River, Kronotzkoe Lake, Zhupanovo, Kronoki, Malki, Anavgai, Pogranich-

nyi, Sosnovka, Elisovo, Petropavlovsk-Kamchatskii (Sedyh, 1979; Lobkova, 1986).

Distribution. Europe, Caucasus, Transcaucasus, Tian-Shan' Mountains, South Siberia, Transbaikalia, Yakutia, Russian Far East (Kamchatka), North America.

Host plants. Betula spp., *Populus* spp. and *Salix* spp.

19. Ptilodon capucina kuwayamae (Matsumura, 1919)

Lophopteryx camelina: Nordström, 1929: 5; Kurentzov, 1963b: 19; Sedyh, 1979: 289; Lobkova, 1986: 114.
Lophopteryx saturata: Sedyh, 1979: 289.
Ptilodon kuwayamae: Tshistjakov, 1985: 62.

Material examined. **Kamchatka Peninsula**: 1 male, 40 km W of Ust'-Kamchatsk, Azhabach'e Lake, 12. VII. 1996; 1 male, 20 km N of Gannaly, 30. VII. 1997; 15 males, 11 km N of Malki, 5. VII. 1996; 3 males, 17 km NE of Malki, 28.VII.1997.

Local occurrence. Esso, Gannaly, Malki, Pogranichnyi, Sosnovka, Ust'-Kamchatsk, Elisovo, Petropavlovsk-Kamchatskii, sea coast between Staryi Semyachik and Tikhaya Rivers, Zhupanovo, Kronoki (Sedyh, 1979; Lobkova, 1986).

Distribution. South Siberia (Novosibirsk, Altai and Sayan Mountains), Transbaikalia, Central Yakutia, Russian Far East (Kamchatka, Middle Amur, Primorye, Sakhalin, South Kuril Islands (Kunashir), North-Eastern and East China, Korea, Japan (Hokkaido, Honshu, Shikoku).

Host plants. Betula spp.

Lymantriidae

20. *Gynaephora rossii* (Curtis, 1835)

Gynaephora lugens Kozhantschikov, 1948: 151; Kozhantschikov, 1950: 241; Sedyh, 1979: 289.

Local occurrence. Koryakskoe Up-land (Kozhantschikov, 1948).

Distribution. Polar Ural Mountains, Taimyr, Khatanga, mouth of Lena River, Selyah River, Novosibirskie Islands, Indigirka River, Vrangel Island, Chukotka, Kamchatka, Greenland, Labrador, Washington Mountains, Alaska, East Sayan Mountains, Primorye (Oblachnaya Mountain), Japan (Hokkaido, Daisetsu Mountains).

Host plants. Salix spp.

Arctiidae

21. *Lithosia quadra* (Linnaeus, 1758)

Oenistes (*sic*) *quadra*: Sedyh, 1979: 289.

Local occurrence. Aga Mountain, near Ichiginskii volcano (Sedyh, 1979).

Distribution. Central Britain, Europe from South Scandinavia to northern part of Iberian Peninsula, Central Balkans, European Russia north to Vyatka, Caucasus, Transcaucasus, northern part of Asia Minor, Russian Far East (Kamchatka, Middle Amur, Primorye, Sakhalin, South Kuril Islands (Kunashir), China (Dunbei, Inner Mongolia, Shaanxi, Yunan), Korea, Japan (Hokkaido, Honshu, Shikoku, Kyushu, Yakushima Island).

Host plants. Lichens.

22. *Eilema atratulum* (Eversmann, 1847)

Material examined. **Kamchatka Peninsula**: 1 male, Baran'ya River, 26. VIII 1987 (Coll. D. Kapust'yan).

Local occurrence. Baran'ya River.

Distribution. Mountains of South Siberia, Mongolia, Yakutia, Russian Far East (Magadan territory, Kamchatka),? North Korea.

Host plants. Lichens.

Remarks. So far this species has been known only in the Russian Far East from the Kolyma river (Magadan territory). During examination of the Lithosiinae collection in the Institute of Biology and Pedology, Far Eastern Branch, Russian Academy of Sciences, Vladivostok, I found one male specimen, undoubtedly belonging to this species. It is recorded here from Kamchatka for the first time.

23. *Setina irrorella insignata* (Staudinger, 1881)

Philea irrorella: Sedyh, 1979: 289.

Material examined. **Kamchatka Peninsula**:

1 male, vicinity of Laso, Larix-Betula wood, 7. VII 1958 (coll. D. Kononov); 1 male, Central'nyi Sovkhos, 16. VII 1958 (coll. D. Kononov); 3 males, 1 female, vicinity of Borovoe, Larix wood, 17. VII 1958 (coll. D. Kononov); 1 male, Shchapino, 27. VII 1960 (coll. E. Safronova); 4 males, 20 km N of Gannaly, 30. VII 1997.

Local occurrence. Laso, Gannaly, Central'nyi Sovkhos, Borovoe, Shchapino (upon the author's material), Esso, Pogranichnyi, Milkovo, Elisovo (Sedyh, 1979).

Distribution. From northern and northeastern Siberia to Chukotka and Kamchatka, mountains of Southern Siberia and Northern Mongolia.

Host plants. Lichens.

24. *Dodia diaphana arctica* Tshistjakov, 1988

Hyaloca (sic) diaphana: Sedyh, 1979: 289.

Local occurrence. Elisovo (Sedyh, 1979).

Distribution. Magadan territory, Kamchatka.

Host plants. Unknown.

25. *Parasemia plantaginis* (Linnaeus, 1758)

Nemeophila plantaginis: Alphéraky, 1897: 328; Herz, 1898: 251.

Nemeophila plantaginis floccosa: Kurentzov, 1963b: 21.

Parasemia plantaginis f. flocoosa (sic): Sedyh, 1979: 289.

Parasemia plantaginis: Dubatolov *et al.*, 1991: 51.

Material examined. **Kamchatka Peninsula**: 1 male, 40 km W of Ust'-Kamchatsk, Azhabach'e Lake, 15. VII 1996; 1 male, 6 km SE of Petropavlovsk-Kamchatskii, 24.VII 1997.

Local occurrence. Ust'-Kamchatsk (upon the author's material), Kluchi, Koryaki, Nachiki (Dubatolov *et al.*, 1991), Esso, Aga Mt., near Ichiginskii volcano, Pogranichnyi, Sosnovka, Malki, Sharomy, Vachkazhez volkano, Milkovo, Elisovo, Petropavlovsk-Kamchatskii, Paratunka, Zhupanovo (Sedyh, 1979).

Distribution. Central Britain, Europe from South Scandinavia to northern part of Iberian Peninsula, Central Balkans, Baltia, Belorussia, Ukraine, European Russia north to Vyatka, Caucasus, Transcaucasus, Kasahstan, Siberia, Evenkia, Yakutia, Russian Far East (south of Magadan territory, Kamchatka, Middle Amur, Primorye, Sakhalin, Kuril Islands (Paramushir, Kunashir), Tibet, China (Dunbei, Inner Mongolia, Shaanxi, Yunan), Korea, Japan (Hokkaido, Honshu, Shikoku, Kushu, Yaku Island), North America.

Host plants. Salix spp., *Plantago* spp., *Taraxacum* spp. and other grassy plants.

26. *Pararctia lapponica* (Thunberg, 1791)

Arctia festiva: Alphéraky, 1897: 199; Herz, 1898: 252.

Pararctia lapponica: Sotavalta, 1965: 173; Dubatolov *et al.*, 1991: 52.

Hyphoraia festiva: Sedyh, 1979: 289.

Local occurrence. Karaginskii Island (Sotavalta, 1965; Dubatolov *et al.*, 1991); Petropavlovsk-Kamchatskii (Sedyh, 1979).

Distribution. Subarctic zone of Eurasia: northern parts of Fennoscandia and European Russia, Taimyr, Yakutia, mountains of Southern Siberia, north of Russian Far East (Magadan territory, Chukotka, Kamchatka), North America.

Host plants. Unknown.

27. *Pararctia tundrana* Tshistjakov, 1990

Pararctia subnebulosa: Sotavalta, 1965: 187.

Pararctia tundrana Tshistjakov, 1990: 97, figs. 1–3; Dubatolov *et al.*, 1991: 53.

Local occurrence. Koryakia, Apuka (Tshistjakov, 1990; Dubatolov, Tshistjakov and Ammosov, 1991).

Distribution. Polar Ural Mountains, Yamal, Taimyr, north of Russian Far East (Magadan territory, Chukotka, Kamchatka).

Host plants. Unknown.

28. *Arctia caja* (Linnaeus, 1758)

Arctia caja: Herz, 1889: 252; Sedyh, 1979: 289; Dubatolov *et al.*, 1991: 55.

Arctia caja kamtschadalis Draudt, 1934: 87.

Material examined. **Kamchatka Peninsula**: 1 male, 17 km of NE Malki, 27.VII.1997.

Local occurrence. Ust'-Kamchatsk, Dal'nii, Pogranichnyi, Sosnovka, Milkovo, Malki, Nachiki, Elisovo, Petropavlovsk-Kamchatskii, Paratunka, Zhupanovo (Cedyh, 1979; Dubatolov, Tshistjakov and Ammosov, 1991).

Distribution. Throughout Eurasia, except extreme north: Central Britain, Europe from South Scandinavia to northern part of Iberian Peninsula, Central Balkans, Baltia, Belorussia, Ukraine, European Russia north to Vyatka, Caucasus, Transcaucasus, Kasahstan, Siberia, Evenkia, Yakutia, Russian Far East (south of Magadan territory, Kamchatka, Middle Amur, Primorye, Sakhalin, Kuril Islands), China, Korea, Japan, North America.

Host plants. *Larix* spp., *Salix* spp., *Ribes* spp., *Plantago* spp., *Taraxacum* spp. and other decidious and grassy plants.

29. *Holoarctia cervini fridolini* (Torstenius, 1971)

Orodemnias cervini: Sedyh, 1979: 289.

Local occurrence. Aga Mt., near Ichiginskii volcano (Sedyh, 1979).

Distribution. Sweden, Kol'skii Peninsula (Khibiny Mountains), Southern Ural Mountains, North of Russian Far East (Chukotka, Kamchatka), Alaska.

Host plants. Unknown.

30. *Hyperborea czekanowskii* Grum-Grshimailo, 1900

Hyperborea czekanowskii: Kurentzov, 1963b: 26; 1966: 69, 74; Sedyh, 1979: 289; Dubatolov *et al.*, 1991: 59.

Local occurrence. Koryakia: Paren' River, Apuka (Dubatolov *et al.*, 1991).

Distribution. Yakutia, Vrangel' Island, north of Russian Far East (Chukotka, Kamchatka, Stanovoi Range), Alaska.

Host plants. Unknown.

31. *Grammia quenseli liturata* (Ménétriès, 1859)

Orodemnias daisetsuzana: Kurentzov, 1963a: 98.

Orodemnias quenseli daisetsuzana: Kurentzov, 1963b: 25.

Orodemnia (sic) quenseli daisetsuzana: Kurentzov, 1966: 68.

Orodemnias quenseli Payk. f. *daisetsuzana*: Sedyh, 1979: 289.

Grammia quenseli liturata: Dubatolov *et al.*, 1991: 59.

Local occurrence. Koryakia: Paren' River, Apuka (Dubatolov *et al.*, 1991).

Distribution. Europe (Polar Fennoskandia, Alps Mountains, Karpaty Mountains), Polar Ural Mountains, Yakutia, Vrangel' Island, North of Russian Far East (Magadan territory, Chukotka, Kamchatka), Alaska, Tarbagatai, mountains of Southern Siberia, Mongolia, North-Western, North and North-Eastern China, Japan (Hokkaido, Daisetsu Mountains).

Host plants. Unknown.

32. *Phragmatobia fuliginosa* (Linnaeus, 1758)

Spilosoma fuliginosa: Herz, 1898: 105.

Phragmatobia fuliginosa: Sedyh, 1979: 289; Dubatolov *et al.*, 1991: 62.

Local occurrence. Kluchi, Padushka River, Sosnovka, Elisovo, Petropavlovsk-Kamchatskii (Sedyh, 1979; Dubatolov *et al.*, 1991).

Distribution. Throughout Eurasia, except extreme north: Central Britain, Europe from South Scandinavia to northern part of Iberian Peninsula, Central Balkans, Baltia, Belorussia, Ukraine, European Russia north to Vyatka, Caucasus, Transcaucasus, Kasahstan, Siberia, Mongolia, Evenkia, Yakutia, Russian Far East (south of Magadan territory, Kamchatka).

Host plants. Polyphagous: *Salix* spp., *Chamaenerium* spp., *Lithrum* spp, *Plantago* spp, *Taraxacum* spp. and other decidious and grassy plants.

Discussion

According to this account the larger moths fauna of Kamchatka contains 32 species belonging to nine families. The low diversity of the larger moths in Kamchatka is explained by the trophic association of the species. Almost all are associated trophically with the broad-leaved vegetation of the temperate and nemoral flora, which is poor in Kamchatka. In particular, nemoral elements among moth species are absent in the region. Moreover, all eight recognized trophic groups (oligophages with lichens, conifers, Salicaceae, Betulaceae, Rosaceae, Rubus, Ribes and polyphages) are also very poor, and each group is represented by a small number or even a single species (Fig. 2). It is remarkable that only *Cosmotriche lobulina* is trophically associated with coniferous plants among the species discussed here. In Kamchatka this species feeds only on *Pinus pumila* shrubs, though it feeds on various coniferous trees within its vast area outside of Kamchatka. All other species from the families under discussion, which are known to be oligophages with the conifers (for example, *Dendrolimus*

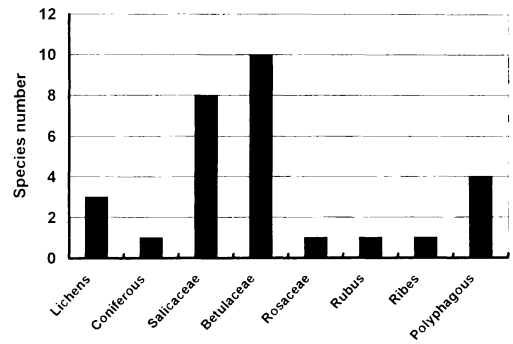

Fig. 2. Categorization of trophic groups of larger moths in Kamchaka (figure in vertical column means number of species).

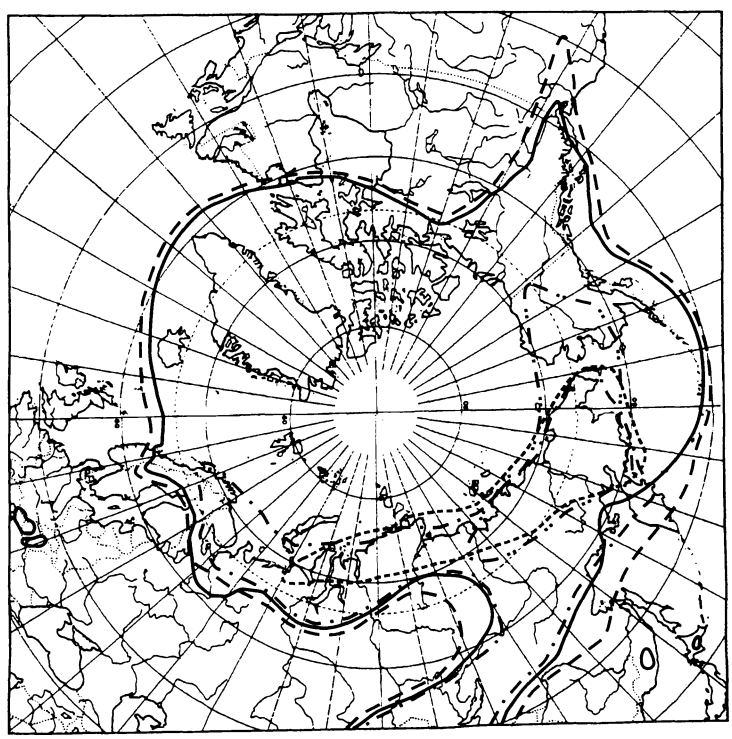

Fig. 3. Disrtibutional patterns of the species occuring in high latitude of the Palaearctic and Holarctic regions.

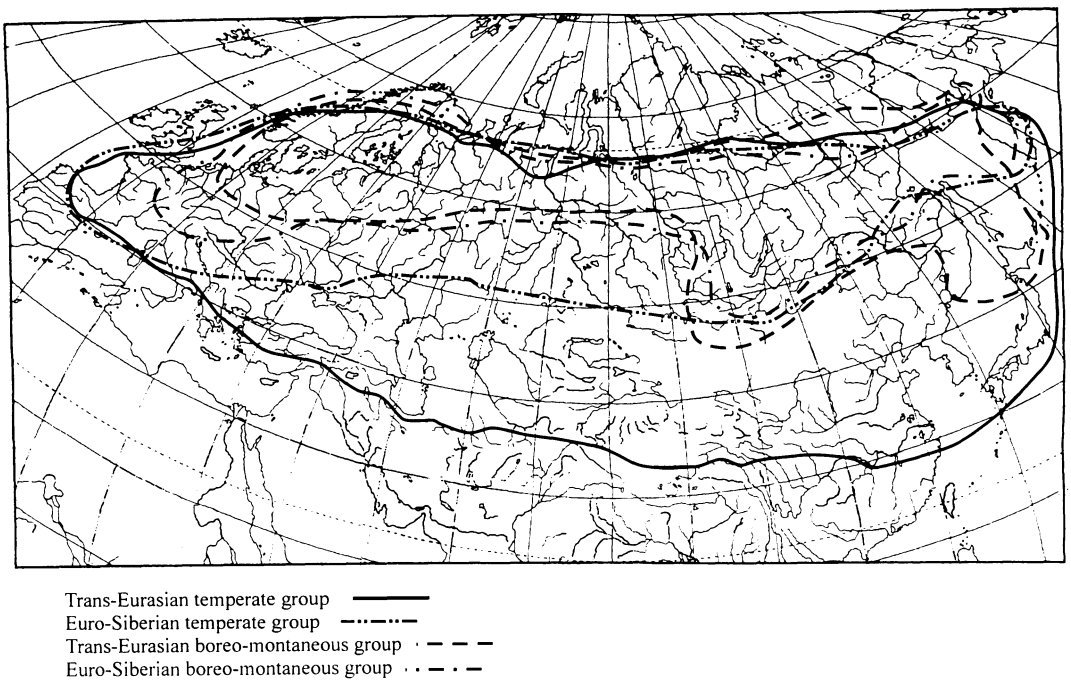

Fig. 4. Disrtibutional patterns of the species widely distributed in the temperate zone of the Palaearctic.

superans sibirica from Lasiocampidae, *Hyloicus morio arestus* from Sphingidae, and *Calliteara abietis* and *Lymantria monacha* from the Lymantriidae) and to be widely distributed in the boreal zone of Eastern Siberia, are absent there. The oligophages with Salicaceae and Betulaceae are especially abundant and richest in number in Kamchatka. Moreover, most of the species known to be polyphagous in the continental part of their areas (Europe, Siberia or in the south of the Russian Far East), are associated trophically under local conditions only with Salicaceae and Betulaceae, known to be common throughout Eurasia. Thus, it becomes clear that the Lepidoptera fauna of Kamchatka is represented mainly by species associated with deciduous trees and shrubs widely distributed throughout the temperate (boreal and subboreal subzones) zone of Eurasia.

Distributional Pattern of Lepidoptera in Kamchatka

From a biogeographical viewpoint, the species listed above may be categorized into four major groups: I, distributed in the high latitudes of the Palaearctic or Holarctic region; II, widely distributed in the temperate zone of the Palaearctic or Holarctic regions; III, with a more or less wide distribution in East Palaearctic; IV, cosmopolitan. The first three groups are further divided into chorological subgroups based on their distributional patterns.

I. Species distributed in high latitudes of the Palaearctic or Holarctic regions (Fig. 3)

1. Holarctic circumpolar arctic-alpine group (one species: *Holoarctia cervini fridolini*). The only species of this group occurs in the high-altitude belt of the European Alps and is then distributed throughout Eurasia and North America above the Arctic Circle, inhabiting mainly the tundra zone.

2. Holarctic circumpolar arctic-alpine-subalpine group (one species: *Grammia quenseli liturata*). The range of this pattern is very similar to that of the previous group, but also penetrates to the high altitude belt of the mountains of Siberia and the Far East up to North Korea (Mt. Paectusan) and Hokkaido (Mt. Daisetsu).

3. Holarctic circumpolar arctic-subalpine group (two species: *Gynaephora rossii* and

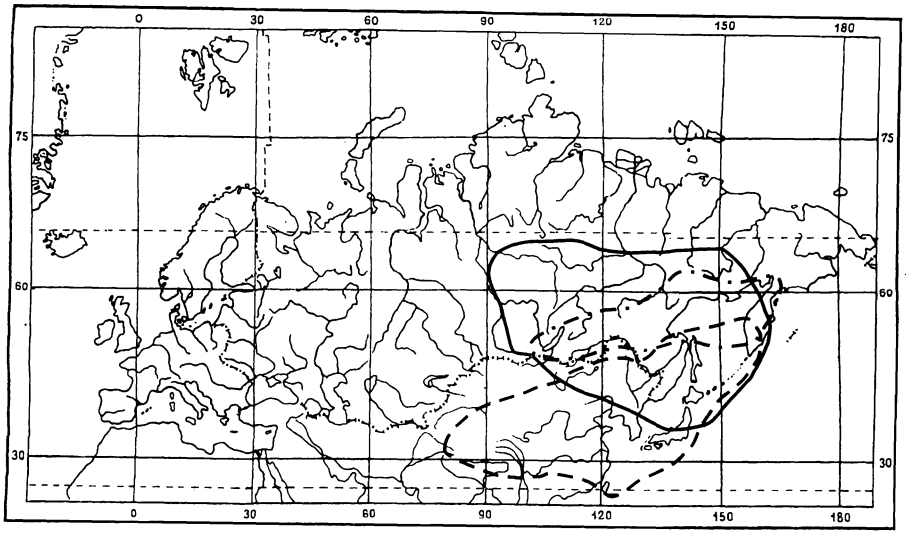

Fig. 5. Disrtibutional patterns of the species with disrtibution in East Palaearctic.

Pararctia lapponica). The range of this pattern is similar to that of group 2, but the species of this group do not occur in the European Alps, and their ranges are not so wide in the Far East: of these, only *Gynaephora rossii* penetrates up to Primorye (Sikhotae-Alin' Range) and Hokkaido (Mt. Daisetsu).

4. Euro-Siberian arctic-subalpine group (one species: *Gazoryctra fuscoargentea*). The range of this pattern is restricted to the Palaearctic region and the species does not reach either Primorye or Hokkaido.

5. Siberian-Nearctic arcto-boreal group (one species: *Hyperborea czekanowskii*). Distributed mainly in the subpolar boggy larch forests and in the tundra zone, from Yakutia to Alaska.

II. Species widely distributed in the temperate zone of the Palaearctic or Holarctic regions (Fig. 4)

6. Holarctic transzonal group (four species: *Hyles gallii*, *Furcula furcula sangaica*, *Parasemia plantaginis* and *Arctia caja*). The species of this group occupy the sub-boreal and, partly, boreal zones of Eurasia and North America, inhabiting mainly the transzonal landscapes, i.e., open grasslands or Salix woods along rivers.

7. Trans-Palaearctic temperate group (one species: *Lithosia quadra*). The only species with transcontinental distribution from the Atlantic and North Africa up to the Pacific Ocean, including the Japanese Islands.

8. Trans-Eurasian temperate group (eight species: *Pennisetia hylaeiformis*, *Synanthedon scoliaeforme*, *S. spheciforme*, *Ochropacha duplaris*, *Tetheella fluctuosa*, *Furcula bicuspis*, *Notodonta torva*, and *Ptilodon capucina kuwayamae*). The range of this pattern is very similar to that of the previous group, but somewhat smaller, not protruding into North Africa, occupying mainly the temperate zone and part of the taiga zone, where they penetrate following their host plants (deciduous trees or shrubs) widely distributed throughout Eurasia.

9. Trans-Eurasian boreo-montane group (one species: *Cosmotriche lobulina*). The only species with a distribution throughout Eurasia, including the Japanese Islands, inhabiting coniferous forests and dense *Pinus pumila* in the taiga zone and a subalpine belt of mountains in the temperate zone.

10. Euro-Siberian boreo-montane group (one species: *Setina irrorela insignata*). The range of this pattern is somewhat similar to that of the previous group, but not as wide, spreading south-east to the mountains of

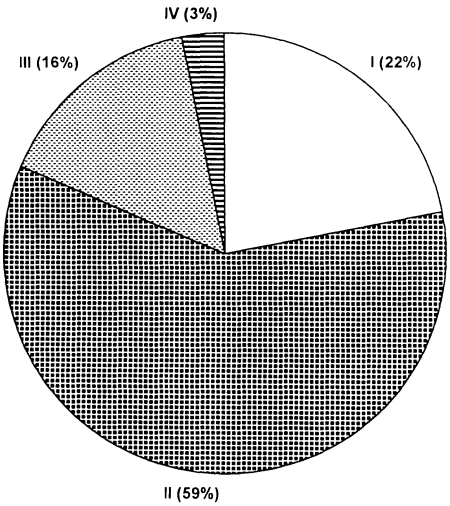

Fig. 6. Biogeographical composition of larger moths in Kamchatka. I, species distributed in high latitude of Palaearctic or Holarctic regions; II, species widely distributed in temperate zone of Palaearctic or Holarctic regions; III, species with disrtibution in East Palaearctic; IV, species of cosmopolitan distribution.

South Siberia and Okhotian sea coast, but not reaching Primorye territory or the Japanese Islands.

11. Euro-Siberian temperate group (three species: *Falcaria lacertinaria*, *Notodonta ziczac*, and *Phragmatobia fuliginosa*). The range of this pattern is similar to that of group (8), but not as wide, and as in the previous case, these species do not penetrate southward of the Stanovoi Range.

12. Asian-American (Amphipacific) temperate group (one species: *Pheosia rimosa*). Distributed in the continental part of the Russian Far East (except the extreme north) and then in North America.

III. Species with more or less wide distribution in the East Palaearctic (Fig. 5)

13. Siberian-Kamchatian arctic-subalpine group (one species: *Pararctia tundrana*). Distributed mainly in the tundra zone, from the Polar Urals to Chukotka. Thus, the range of this pattern resembles the Siberian part of the group (5), as pointed out above for *Hyperborea czekanowskii*.

14. Siberian-Pacific temperate group (one species: *Synanthedon herzi*). The only species of this group is distributed eastward from the Enisei River to Japan, inhabiting mainly the intrazonal landscapes, such as Salix woods along rivers.

15. Siberian-Kamchatian boreo-montane group (two species: *Eilema atratulum*, *Dodia diaphana arctica*). Distributed from South Siberia to the Okhotian sea coast, and then in Kamchatka, inhabiting subalpine landscapes with mountain tundra.

16. East-Asian sub-boreal (nemoral) group (two species: *Marumba gaschkewitschi* and *Notodonta dembowskii*). The first species of this group is widely distributed in East Asia (throughout China, Mongolia, south of the continental part of the Russian Far East, Taiwan, Japan) and then, after wide disjunction, in Kamchatka. The second species is also widely distributed in the Far East. In the main parts of their areas, both species inhabit nemoral mixed forests and are trophically associated with broad-leaved plants, typical for this flora.

IV. Species of cosmopolitan distribution

17. Cosmopolitan group (one species: *Synanthedon tipuliforme*). The only species in this group is known to be widely distributed throughout the world, being introduced in many countries due to human activity, the planting of cultivated kinds of currants.

This brief zoogeographic account shows that the fauna of the discussed families in Kamchatka consists mainly of taxa widely distributed in the temperate zone of the Palaearctic or even Holarctic (19 species, 59% of the total species composition), while arctic and East Palaearctic elements are represented there by a small number (seven species, 22% and five species, 16%, respectively) (Fig. 6). Especially numerous are the Trans-Eurasian temperate, Euro-Siberian temperate and Holarctic transzonal species, which comprise almost half (45%) of the local taxa. It is remarkable that all the species mentioned are represented in Kamchatka by the same geographical forms as those occurring throughout the temperate zone of Eurasia. Some subspecies (e.g., *Furcula furcula sangaica*, *Ptilodon capucina kuwayamae*, and *Setina irrorella insignata*) are common in neighboring territories and widely distributed in at least

the East Palaearctic. The real systematic position of some subspecies (e.g., *Gazoryctra fuscoargentea sordida* and *Arctia caja kamtschadalis*) is still unclear. It should be emphasized that there are no endemic taxa (neither specific nor subspecific rank) among the representatives of the discussed families in the Kamchatian fauna. Kurentzov (1963; 1966) argued that the presence of many temperate species in Kamchatka might be attributable to relicts, surviving under local conditions during the second half of the Pleistocene at least. However, the zoogeographic features of the species discussed here are not consistent with Kurentzov's view. The absence of endemic taxa in Kamchatka testifies rather to the young age of its Lepidoptera fauna, which could have been formed after the last glacial epoch, and most likely the core of this fauna penetrated to Kamchatka during the climatic optimum of the Holocene.

Acknowledgments

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カムチャッカ半島産大型ガ類（シャクガ科とヤガ科を除く）のチェックリストおよびその動物地理に関する考察

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カムチャッカ半島産の大型ガ類について，チェックリストを作成し，9科32種を記録した．そのうち，*Eilema atratulum* は，カムチャッカ新記録である．また，*Eilema atratulum* の2亜種，*Palimpsestis duplaris kamtschadalis* Sheljuzhko 1926 と *Palimpsestis duplaris malaisei* Nordstrom 1929 を，基亜種のシノニムとした．カムチャッカのガ類相を形成する多くの種は，ユーラシアの亜寒帯に広く分布する落葉性樹や灌木に食性を依存している．動物地理学的には，カムチャッカのガ類相は，大きく分けて以下の4つの要素から構成されている：旧北亜区あるいは全北区の高緯度に分布する種；旧北亜区あるいは全北区の温帯域に広く分布する種；旧北亜区東部に分布する種；汎世界的な分布を示す種．カムチャッカ固有種は存在せず，このことは，本地域のガ類相の歴史が浅いものであることを示している．カムチャッカのガ類相は，最終氷期の後，完新世の間の気候条件が最適の時期に形成されたものであることが示唆される．